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Mutagenic Efficiency of MMS and Gamma Rays in Fenugreek (*Trigonella foenum-graecum L.*)

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Abstract Fenugreek seeds of variety UM 75 were treated with three concentrations () of methyl methane sulphonate (MMS) and gamma rays for inducing micro mutations.. In M1 generation, 0.08% MMS induced maximum cytological damage which was followed by 60 and 80 Kr of gamma rays. In M2 generation, 0.06% MMS induced high genetic variability for most of the yield contributing traits, whereas gamma rays induced genetic variability only for pod length, number of grains per pod and test weight with very low values.

key words *Fenugreek, Genetic variability,* Mutations

Fenugreek is used as condiment, spice and vegetable. The seeds are rich in protein. Now–a days, it is gaining much importance as a medicine. Traditional methods have not resulted in improving the genetic potential of this crop mainly due to limited amount of genetic variability available. Mutation breeding has been successfully used to generate genetic variability using MMS and gamma rays in many crops viz., mungbean (Khan & Irfan 1983), broad beans (Kasim *et. al.*, 1977)and cowpea (Oomen & Gopimony 1986). Very little work on this aspect has been done in fenugreek. Therefore, an attempt was made to investigate the mutagenic efficiency of MMS and gamma rays particularly in terms of induction of micromutations in fenugreek.

Materials and Methods

Seeds of fenureek UM-75 were soaked in distilled water for four hours and treated with freshly prepared solutions of MMS 0.04, 0.06 and 0.08% at concentrations for 6h. The three doses of gamma rays irradiation viz., 40, 60 and 80 kr were used. Irradiated seeds were kept in distilled water during entire treatment duration. M1 generation was raised in both plates and field using randomized block design with three replications. For M2 generation 20 normal appearing M1 plants were

Table 1 *Frequency of chromosomal aberrations during mitosis under different treatment in M1 generation of fenugreek.*

Treatment	Number of cells analysed		Leg	Bredited	Dob	Brid	Cloup	Unequal separatio n	Total	%
	Metaphase	Anaphase								
Contro	25	25	–	–	–	–	–	–	–	–
MMS 0.04%	28	22	2	1	1	–	–	–	4	8
MMS 0.06%	23	27	2	2	–	2	1	–	7	14
MMS 0.08%	22	28	2	3	–	3	1	2	11	22
Gamma rays 40 Kr	24	26	1	2	2	3	1	–	9	18
Gamma rays 60 Kr	24	26	2	–	2	3	1	2	10	20
Gamma rays 80 Kr	23	27	2	–	3	3	2	–	10	20

selected from each treatment. They were raised in compact family block design with three replications. Four meter long single rows of each progeny were raised. Row to row and plant to plant distances were maintained as 40 and 15 cm, respectively. Statistical analysis of variance, GCV, PCV, heritability and genetic gain was done in all those families which exhibited significant progeny differences. Progenies significantly superior over the control were isolated using 't' test.

Results and Discussion

In M1 generation, MMS treatment reduced the means of most of the characters except days to 50% flowering, number of grains per pod, pod length and test weight which remained unaffected. The doses of gamma rays also caused reduction in means of most of the traits except days to 50% flowering, days to maturity and number of branches per plant. It showed an increase in test weight at. Chromosomal aberrations were maximum at 0.08% MMS followed by 60 and 80 Kr of gamma rays (Table 1).

Since normal appearing plants without any sterility effects were available in only lower and intermediate doses of both the mutagens, they were carried forward to M2 generation. Maximum genetic coefficient of variation (GCV) with high estimates of heritability and genetic gain was generated by 0.06% MMS treatment for all the yield contributing traits viz., pod length, number of pods per plant, number of grains per pod, test

Table 2 *Coefficient of genotypic and phenotypic variation, heritability and genetic gain as percentage of mean for yield contributing traits in M2 generation*

Treatment	Coefficient of variation (%)		Heritability (%)	Genetic gain
	Genotypic	Phenotypic		
		Pod length		
MMS 0.06	6.94	10.20	46.26	10.26
Gamma rays (40 Kr)	5.91	8.48	48.58	8.51
		Number of pods plant^{-1}		
MMS 0.06	17.82	32.68	29.74	9.26
		Number of grains pod^{-1}		
MMS 0.06	16.09	18.82	73.10	28.37
Gamma rays (40 Kr)	6.68	10.44	41.01	8.77
Gamma rays (60 Kr)	10.33	16.94	39.20	13.82
		Test weight		
MMS 0.04	9.16	12.23	56.07	14.43
MMS 0.06	6.67	11.49	33.65	8.16
Gamma rays (60 Kr)	7.23	9.29	61.89	11.32
		Yield plant^{-1}		
MMS 0.06	15.56	29.37	28.06	16.94

weight and yield per plant. It suggests that lower doses of mutagens should be used to induce micromutations. Gamma rays treatment generated variability only for pod length, number of grains per pod and test weight but its magnitude was lower than that of MMS. Further 0.06% MMS was the only treatment which generated significant genetic variability for yield per plant but the estimates of heritability were moderate (Table 2).

Superior progenies over the best progeny of control were identified for pod length and yield per plant at 0.06% MMS treatment. Laxmi et al. (1982) demonstrated that gamma rays treatment showed superior progenies over control for pod length. The magnitude of increase was higher in case of MMS than gamma rays. Thus MMS proved to be more effective than gamma rays for induction of micromutations in fenugreek (Table 3).

Table 3 *Progenies superior over the best progeny of control for various traits in M2 generation of fenugreek*

Treatment	Progeny	Per cent increase over control
	Pod length	
MMS. 0.06%	5	37.4
	1	36.2
	3	34.1
	17	32.9
	3	29.2
Gamma rays (40 Kr)	16	28.6
	17	26.5
	4	26.4
	6	26.3
	7	26.2
	9	21.9
	18	21.8
	Yield plant^{-1}	
MMS 0.06%	2	54.1
	10	40.9
	17	34.5
	13	30.0
	20	24.5

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